Fordham

FINAL REPORT, RESEARCH GRANT NsG-341

The carbonaceous meteorite research, conducted between November 1, 1962 and October 31, 1963, resulted in a better understanding of a) the nature of the solvent soluble organic matter in carbonaceous meteorites and b) the nature of the meteorite microstructures, i.e. organized elements. In addition, c) mineralogical and petrographic studies resulted in a better understanding of the environment(s) of the parent bodies of carbonaceous meteorites.

Samples of the Orgueil carbonaceous meteorite were extracted with a mixture of benzene-methanol in a Soxhlet apparatus, the extracts were saponified with KOH, reextracted with water, acidified and reextracted with ether. Infrared spectra of these ether soluble fractions showed characteristic carboxylic acid patterns. These fractions were also found to be slightly levorotatory, particularly at wavelengths around 435 mμ. Various terrestrial control samples were identically prepared such as saponifiable fractions from pollen grains, museum dust, soil, and various plant and animal tissues. The control samples were found to be slightly dextrorotatory. (These preliminary findings were confirmed and the analytical procedures involved were further developed during the duration of a subsequent research grant NsG-541. At that time the results were published, Nature, 202, 228, 1964).

The organized elements in the Orgueil and Ivuna carbonaceous meteorites were found to represent a heterogeneous group of particles. Some appeared to be mere terrestrial contaminations, others seemed to be mineral grains, however there were some indigeneous particles found in carbonaceous meteorites which contained approximately 30 percent iron 1-2 percent chlorine upon analysis with the electron microprobe. Such particles also contained acid insoluble residues which appeared to consist of organic matter. The results of the electron microprobe x-ray analysis were published in Nature, 198, 121, 1963. Ultramicrospectroscopic, ultraviolet spectral analysis of the acid insoluble residues showed absorption bands at 260 and 280 mμ wavelengths.

These spectral features may indicate, but do not necessarily prove, the presence of nucleic acid and protein constituents in the organized elements. The results were published in Nature, 200, 565, 1963.

Mineralogical and petrographic studies showed that the Orgueil and Ivuna carbonaceous meteorites consist of a brecciated aggregate of micaceous minerals, iron oxides, iron-magnesium carbonates, elementary sulfur and magnesium sulfate. Electron microprobe analysis showed that the carbonate mineral was breunnerite, and that in addition gypsum and the phosphate mineral, merrillite, appear to be also present. The mineral composition and texture of Orgueil and Ivuna suggest an aqueous and low temperature environment on the meteorite parent bodie(s). It appears that the terrestrial rocks which are most similar in mineral composition and texture to Orgueil are certain pyroclastic sediments, such as consolidated volcanic ash deposited in or penetrated by liquid water.

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